DOCUMENT RESUME

ED 204 367 TM 810 353

AUTHOR Ginsburg, Alan: And Others
TITLE Summer Learning and the Effects of Schooling: A Replication of Heyns.
PUB DATE Apr 81
NOTE 35p.: Paper presented at the Annual Meeting of the American Educational Research Association (65th, Los Angeles, CA, April 13-17, 1981).

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Academic Achievement: Achievement Gains: Attendance: *Compulsory Education: Correlation: Elementary Education: Elementary School Mathematics: *Experiential Learning: *Longitudinal Studies: Racial Differences: Reading Achievement: *Socioeconomic Status
IDENTIFIERS Comprehensive Tests of Basic Skills: Research Replication: *School Effectiveness: *Sustaining Effects Study

ABSTRACT

In Summer Learning and the Effects of Schooling, Barabara Heyns found that schooling has a marked impact on achievement. This conclusion is based on analyses that show school-year achievement gains are greater than summer gains, summer being considered a temporary absence of schooling. Heyns' data came from a household survey and school-administered standard achievement reading tests of 2,978 grade 6-7 students in Atlanta. Students were tested three times during a calendar year. A replication of Heyns' analyses using the Sustaining Effects Study of Title 1 data base, a nationally representative sample of 15,579 students in grades 1-6 in 1975-76 was undertaken. Extensive home interviews and achievement tests in math and reading for fall and spring were available for all the students, and achievement tests over three years were available for a nonrandom sample of about 2,500 students. The replication results support Heyns' finding that school-year achievement gains are greater than summer gains, especially for math achievement. Achievement levels were found to be related to student socioeconomic background, but learning in either the summer or the school year was found to be unrelated to socioeconomic status. (Author/RL)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED2043367

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☒ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

SUMMER LEARNING AND THE EFFECTS OF SCHOOLING: A REPLICATION OF HEYNS

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Baker, K
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Alan Ginsburg
Keith Baker
David Sweet
U. S. Department of Education

Alvin S. Rosenthal
AUI Policy Research

Paper presented at the Annual Meeting of the American Educational Research Association, Los Angeles, April, 1981.

TM 811 353

ABSTRACT

In Summer Learning and the Effects of Schooling, Barbara Heyns found that schooling has a marked impact on achievement. This conclusion is based on analyses that show school-year achievement gains are greater than summer gains. She also found that schooling promotes equality, in that school-year learning does not differ so greatly by race or socioeconomic status as does summer learning.

Heyns' data came from a household survey and school-administered standard achievement reading tests of 2,978 sixth- and seventh-grade students in Atlanta. Students were tested three times during a calendar year.

We undertook a replication of Heyns' analyses using the Sustaining Effects Study of Title I data base, a nationally representative sample of 15,579 students in grades 1 to 6 in 1975-76. Extensive home interviews and achievement tests in math and reading for fall and spring were available for all the students, and achievement tests over three years were available for a nonrandom sample of about 2,500 students.

The replication results support Heyns' finding that school-year achievement gains are greater than summer gains. We found this especially true for math achievement. Partial support was found for the relationship between background and achievement. Achievement levels were found to be related to student socioeconomic background, but learning in either the summer or the school year was found to be unrelated to socioeconomic status. Support was not found for a relationship between the rate of school attendance and school-year learning.

In summary, our findings show that school provides equal access to learning, but that initial achievement differences by race and socioeconomic status change very little over the course of students' elementary school careers.

INTRODUCTION

One of the most significant studies of school achievement in recent years is Barbara Heyns' (1978) Summer Learning and the Effects of Schooling. Heyns argues that schooling has a marked impact on achievement, especially among disadvantaged and minority students, and that education promotes equality by reducing racial and socioeconomic differences in achievement.

The importance of Heyns' study lies in the demonstration that "compulsory schooling really does make a difference, just as educators have always claimed" (Jencks, 1978, p. xi). Further, Heyns found the effects of school to be especially important for disadvantaged students. That is, going to school is equalizing, in that schooling reduces preexisting differences in achievement between high and low socioeconomic groups. As Jencks (1978, p. xii) points out, "This conclusion is at odds with the currently conventional wisdom about schooling," that is, the conclusion of the Coleman et al. (1966) report that schooling does not affect achievement differences among socioeconomic groups. Jencks goes on to note that Heyns' findings have major policy implications for the education of disadvantaged students.

Given the importance of the policy implications of Heyns' study and its challenge to the current conventional wisdom, replication of Heyns' findings is vital. Although single studies can occasionally challenge and overturn the conventional wisdom, they are more often dismissed as the exception. Heyns examined students in only two grades in one city over just 12 months. Before Heyns' findings can replace the currently-accepted ones, they must be shown to be more generally applicable.

The purpose of this study was to test the general applicability of Heyns' findings by replicating her analysis on a data base drawn from some 250 schools across the country and with longitudinal data spanning three school years.

The ideal method to examine the school effect on achievement would be to assign some children to go to school and other children to stay home. Since this method is not possible, Heyns compared learning over the school year with summer learning. Multiple test-date data were used to examine differences between school-year and summer learning. Because summer can be considered a temporary

absence of schooling, the difference in learning between the school year and summer can be considered the school effect.[1] Heyns' principal findings were that school-year learning is greater than summer learning and that school-year learning is more equal across groups than is summer learning.

We undertook a replication using data from the Sustaining Effects Study of Title I (Hoepfner et al., 1977). In order to replicate Heyns' analysis on the Atlanta sample as closely as possible, we used methods of analysis identical to those used by Heyns in her study whenever we could. This report summarizes our findings with respect to analyses on school-year vs. summer learning, as reported in Part I of her book. We do not report on learning during the summer, except as it replicates Heyns' analyses in the first part of her book. We are now preparing a critique of the methods Heyns used in her analysis and therefore do not discuss her methodology extensively in this paper.

Table 1 presents a summary of Heyns' findings and our replication results. The table lists the questions addressed by Heyns, the analyses she did, her findings and the findings from our replication. The table and this paper are organized by her book chapters. Heyns' second chapter discusses the background of the Atlanta sample, so the following section deals with the Sustaining Effects data base and sample background. The next three sections report replications of the analyses in these three chapters of Heyns' study: "The Effects of Schooling"; "Socioeconomic Background and Schooling"; and "The Effects of Attendance." A final section summarizes the conclusions from our study.

Data Base and Background of the Sample

In Chapter 2 of her book, Heyns described her sample and presented simple descriptions of the students' achievement. Her study was based on a household survey and school-administered standard achievement test of 2,978 sixth- and seventh-grade students in Atlanta. Three analyses introduce the reader to the data: achievement as a causal chain; partial correlations of achievement level with income, controlling for prior achievement; and regressions of achievement level on prior achievement.

TABLE 1

Summary of Findings

Heyns' Chapter	Question Addressed	Type of Analysis	Heyns' Finding	Sustaining Effects Study Finding
2	What is the structure of the data and intercorrelations?	Path Diagram	Effect of prior achievement	Achievement does not increase monotonically over time.
		Test scores auto-correlated.	Similar structures are found.	
	What is the relationship or background to learning?	Partial correlation, controlling for prior achievement.	Income is more closely related to learning in school year than learning in summer.	Correlations are lower and do not differ by time of year.
	What is the change in achievement over time?	Regression of achievement on prior achievement.	Coefficient for school year is higher than for summer.	Little difference exists between school-year and summer coefficients.
3	Is school-year learning greater than summer learning?	Ratio of monthly school-year to full-year achievement gains.	School-year gains are larger.	Relationship is found.
			Blacks and lower income groups have larger ratios.	Few differences among groups.
	What is the effect of background in the comparison?	School-year gains by race, income, among high-status schools.	More equal gains in achievement are found among high-status schools for different income groups.	No pattern differences are found in high-status vs. low-status schools.

TABLE 1 (cont'd)

Heyns' Chapter	Question Addressed	Type of Analysis	Heyns' Finding	Sustaining Effects Study Finding
4	What is the effect of background on achievement level?	Regression of achievement on income, parents' education, and household size.	All predictors are significant.	Parents' education and race are found to be significant. Other variables are sometimes found to be significant.
	What is the effect of background on achievement change?	Control also for prior achievement.	Race, education are still found to be significant. Income is found significant only for fall achievement	Parents' education and race are found to be sometimes significant.
		Prior achievement significant, effects largest in summer.	Prior achievement is found to be significant, with coefficients similar for fall and spring.	
	Is school year learning greater than summer learning?	Addition of "school-year difference" term and interaction terms to model.	During the school year, learning is found to be greater than learning in the summer.	Relationship is found.
			Effect of background is found to be greater on summer learning than on school-year learning.	Effect of background is found not much different in summer learning and school-year learning.

TABLE 1 (cont'd)

Heyns' Chapter	Question Addressed	Type of Analysis	Heyns' Finding	Sustaining Effects Study Finding
4	Does effect of background lessen over time?	Correlation of socio-economic status and achievement.	Effect decreases in the higher grades.	Relationship is not found.
5	What is the effect of absenteeism on achievement?	Regression of achievement on school attendance, prior achievement.	The greater the absenteeism, the lower the achievement.	Relationship is not found.
	What is the effect of absenteeism on achievement with control for background?	Add control for socio-economic status.	Relationship between absenteeism and achievement remains.	Relationship is not found.
	What background groups have highest school attendance?	Mean attendance by race and income.	Blacks have higher attendance than whites.	Small relationship is found.
			Higher income students have higher attendance.	Relationship is found.

Data Base

This study uses data from the Sustaining Effects Study of Title I. The Sustaining Effects Study is a national, stratified, cluster sample selected in 1975-76. It includes about 133,000 students in grades 1 to 6 in more than 250 schools. From this sample, slightly over 10 percent of the students from each school (a total of 15,579 students) were randomly selected for a household survey. Interviews were conducted with one or both parents. After the first year of the study, the sample ceased to be nationally representative. Between the first and second years of the study, approximately half of the schools and three-fourths of the students in the household sample were dropped from the study for budgetary reasons.

The analyses presented in the next section use either the full sample of 15,579 or a much smaller sample, depending on how many years of data are required. For the analyses of achievement levels of students, data from the first year of the Sustaining Effects Study were used, and the 15,579 student sample is a national probability sample. For these analyses, statistical tests are accurate measures of the probability of obtained differences.

When data for more than one year are required -- as when achievement change during the school year is compared with achievement change during the summer -- data for only about 2,500 students were available for the analysis. Since these students are not a random sample, significance tests are not accurate and statements of probabilities should be taken only as indicators of possible differences.

Achievement Measures

In Chapter 2 of her study Heyns reported data for nine subtests of the Metropolitan Achievement Tests but limited her substantive analyses in the balance of the book to the "Word Knowledge" subtest. The Sustaining Effects Study uses the Comprehensive Test of Basic Skills (CTBS). We used both total reading and total math test scores. Tests were given in the fall and spring in each of the three years of the study.

Because the analysis requires looking at scores across grades, and different levels of the test are given in different grades, the metric used in the analysis was the Vertical Scale Scores (VSS), provided by System

Development Corporation as a part of the Sustaining Effects Study. (See Hemenway et al., 1978, pp. 7-62, for a description of the computation of the VSS.) The VSS equates the scores on different levels of the CTBS and gives a common metric permitting a measure of achievement change across test levels and, therefore, over several grades. In this way we are able to follow a student over three school years and two summers in order to better estimate differences between school-year and summer achievement.

The analysis covers two types of achievement measures: change (gain or learning) and level. We use the term "achievement" to refer to both of these measures.

Achievement as a Causal Chain

In Figure 2.1, page 36 of her study, Heyns presented a model diagraming achievement over time with associated correlations of residuals to demonstrate "the degree of autocorrelation in test scores" and "the increasing magnitude of the direct effect of pretest on posttest observed at each subsequent date."(p.35)

In addition to bei , a part of a replication of Heyns' analysis, replicaton at this model can also be taken as a test of the similarity of the underlying achievement process in the two studies. If the paths from test to test and the pattern among the residuals are similar in the two sets of data, we have reason to believe both studies are examining the same basic causal process.

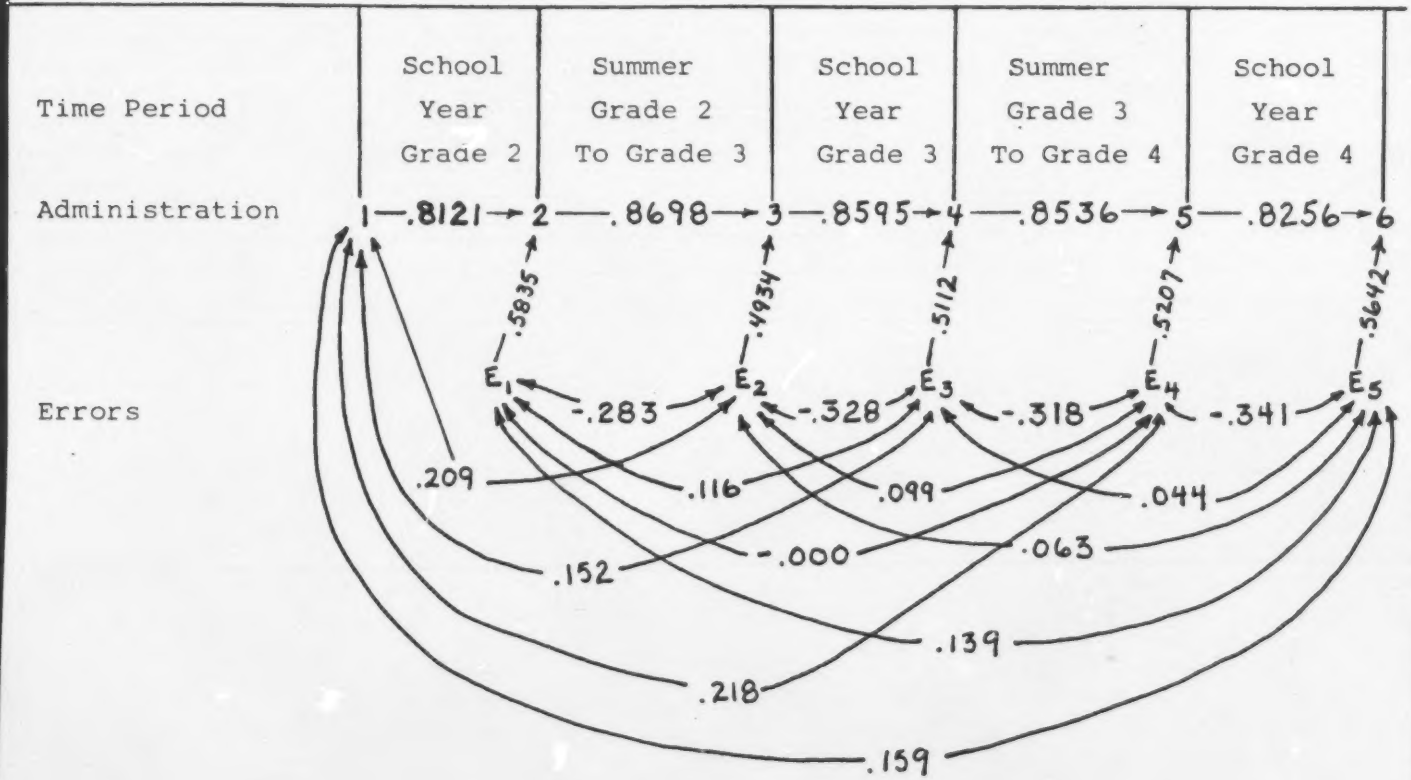
We calculated this model for reading and math tests for each cohort (group of students in the same grade in the first year of the study) in the Sustaining Effects Study. An example of one of these models is presented in Figure 1.

All analyses were carried out separately by grade or cohort, meaning that, depending on the time interval involved, there were from three to six replications of each analysis within the Sustaining Effects data. To make the data presentation brief, we present only one of each grade or cohort replication in this paper. In all cases, however, the reported example is typical of the findings across all grade or cohort replications.

As can be seen in Figure 1, the correlations between successive tests (paths from one test to another) are between .81 and .87. The magnitude of these path

FIGURE 1

Path Diagram of Achievement Test Scores and Correlation of Residuals for Reading Vertical Scale Scores of Students in Grade 2 in First Year of Study



coefficients are approximately the same as those found by Heyns, but they differ in that Heyns found that the coefficients increase monotonically over time while the coefficients in Figure 1 do not. Heyns' conclusion that the "pattern of ... increasing explained variance persists" is not found in our replication.

The pattern of correlations among residuals in our replication Figure 1 is very similar to the pattern found by Heyns. Correlations between residuals of adjacent tests are approximately -.3, while those between residuals of tests one year apart are about +.1. These correlations probably represent, as Heyns suggests, the actions of variables that act on each achievement score but are not included in the model. The fact that the values of these correlations in both data sets are in the same range suggests that similar casual processes may be operating. We conclude, therefore, that we are justified in using the Sustaining Effects data in a replication of Heyns.

Partial Correlations of Achievement with Income

Heyns presented partial correlations between the score on each subtest and family income, controlling for prior test score in her Table 2.4. Her purpose was to indicate the importance of socioeconomic background, as measured by income, on learning. She found that level of students' family income is more closely related to students learning achievement during the summer than during the school year and she argues that schooling may have an effect on equalizing access to learning.

Table 2 presents a summary of Heyns' findings and of our findings from the Sustaining Effects Study. In the Sustaining Effects data the partial correlations are much lower than those found by Heyns. Further, our data do not show the pattern of larger partial correlations for the summer than for the school year that Heyns found.

The lower and more equal partial correlations imply that socioeconomic status and learning are much less closely related than Heyns reported. This suggests that once learning differentials are formed among students, they remain approximately the same throughout elementary schooling, and over the summer. These results are further supported by the analyses presented in the next section.

TABLE 2

Mean Partial Correlations Between Achievement and Income, Controlling for Prior Achievement

Test Date	Heyns Data: All Subtests	Heyns Data: Word Knowledge	SES Data: Math CTBS/VSS	SES Data: Reading CTBS/VSS
Spring	.205	.184	.104	.088
Fall	.254	.283	.085	.104

KEY: SES = Sustaining Effects Study
CTBS = Comprehensive Test of Basic Skills
VSS = Vertical Scale Score

SOURCE: For Heyns data: Calculated from Heyns (1978), Table 2.4, p. 32.

Regressions of Achievement on Prior Achievement

Heyns presented three simple regressions of posttest on pretest using grade equivalent scores in order to examine school-year vs. summer learning. Her major finding (reported in her Table 2.5) is that the regression coefficient is smaller for the summer than for the school year, implying that more learning occurs during the school year than over the summer.

Grade-equivalent (GE) scores were not available in the Sustaining Effects Study so an identical analysis could not be carried out. The authors of the Sustaining Effects Study gave up on trying to develop GE scores because of the poor psychometric properties of the GE metric (Hemenway et al., 1978). Hemenway et al. (1978) found the VSS to have much more desirable psychometric properties than do GE scores. A similar analysis using VSS produced no pattern of differences among summer vs. school-year regression coefficients. Other findings, presented in the next sections, do support Heyns' results of greater learning during the school year. The difference here may be due to the use of VSS instead of GE scores.

The Effects of Schooling

In Chapter 3 of her study, Heyns began her analyses of the effects of compulsory schooling on achievement. She stated three important conclusions about the effects of schooling:

- Summer gains in achievement are lower than school-year gains; that is, school helps students learn.
- White students have higher achievement levels than black students, and students whose families have high incomes have higher achievement levels than stduents whose families have low incomes.
- Gains in achievement during the school year are more uniform in high-status then in low-status schools.

Summer vs. School-Year Achievement Gains

In Table 3.3, page 50 of her study, Heyns presented the ratio of monthly gains during the school year to average monthly gains over entire calendar year. She found that school-year achievement gains are larger than gains for the whole year and that the lower the family income, the larger this ratio is.

Table 3 replicates Heyns' table with VSS for students in grade 5 during the first year of the study.2/ The ratios for reading are not quite so large as those reported Heyns but are larger than 1.0. The ratios for math are larger than those for reading. The implication of Table 3 is that schooling does increase achievement gain, when compared with summer achievement gain, which is also what Heyns found.

Figures 2 and 3 present VSS for the cohort in grade 4 the first year of the study.3/ In both figures, and particularly in math (Figure 3) the slope of the gains for all groups shown is much steeper from fall to spring (the school year) than from spring to fall (summer). These figures graphically illustrate that the school learning effect is much larger than the summer learning effect.

Although the regression coefficients discussed in the preceding section did not replicate Heyns' findings of more learning during the school year than over the summer, the analysis in this section provides compelling support for the conclusion that learning, as measured by standardized achievement tests, is a consequence of attending school rather than a product of home background differences. Math achievement differences were larger than reading achievement differences. This result is consistent with the notion that students continue to do some reading during the summer, but are much less likely to practice their mathematics skills. It would have been interesting had Heyns presented both math and reading results. It would be reasonable to expect that, in the Atlanta sample as well, school-year-summer differences in math achievement would have been larger than those in reading.

Control for Income and Race

In her study Heyns found that whites have higher achivement levels than blacks and students from families with high incomes have higher achievement levels than

TABLE 3

Ratio of Monthly VSS Gain During the School-Year to Monthly VSS Gain for Whole Year by Race and Income for Grade 5 Students in First Year of Study[a/][b/]

Race and Income		Heyns Mean	Math	Reading
Whites		1.36	1.66	1.12
Income level[b/]	(1)	-	2.13	1.25
	(2)	1.97	1.74	1.26
	(3)	1.35	2.05	0.93
	(4)	1.24	1.60	1.50
	(5)	--	1.62	1.25
Blacks[c/]		2.01	1.30	1.11
Income level	(1)	3.18	1.30	1.28
	(2)	2.35	0.97	1.14
	(3)	1.93	--	--
	(4)	1.23	--	--
	(5)	--	--	--
Hispanics[c/]		--	1.30	1.32

a/ Data are (1) calculated from Heyns (1978, Table 3.3) and are the mean of grades 6 and 7, and (2) Sustaining Effects Study Vertical Scale Scores (VSS).

b/ Students in grade 5 the first year are the oldest cohort for which this analysis can be computed in the Sustaining Effects Study.

c/ Income levels in the Sustaining Effects data are in quintiles for all students, with (1) being lowest and (5) being highest. The values for Heyns' data are (1) less than $4,000, (2) $4,000 - $8,999, (3) $9,000 - $14,999, and (4) $15,000 and above.

d/ For blacks only, income levels (1) and (2) had at least 10 students. For Hispanics, no income level had as many as 10 students. Heyns presents no data for Hispanics.

FIGURE 2

MEAN MATH VERTICAL SCALE SCORES FOR COHORT IN GRADE 4 IN FIRST YEAR OF STUDY, BY RACE AND INCOME

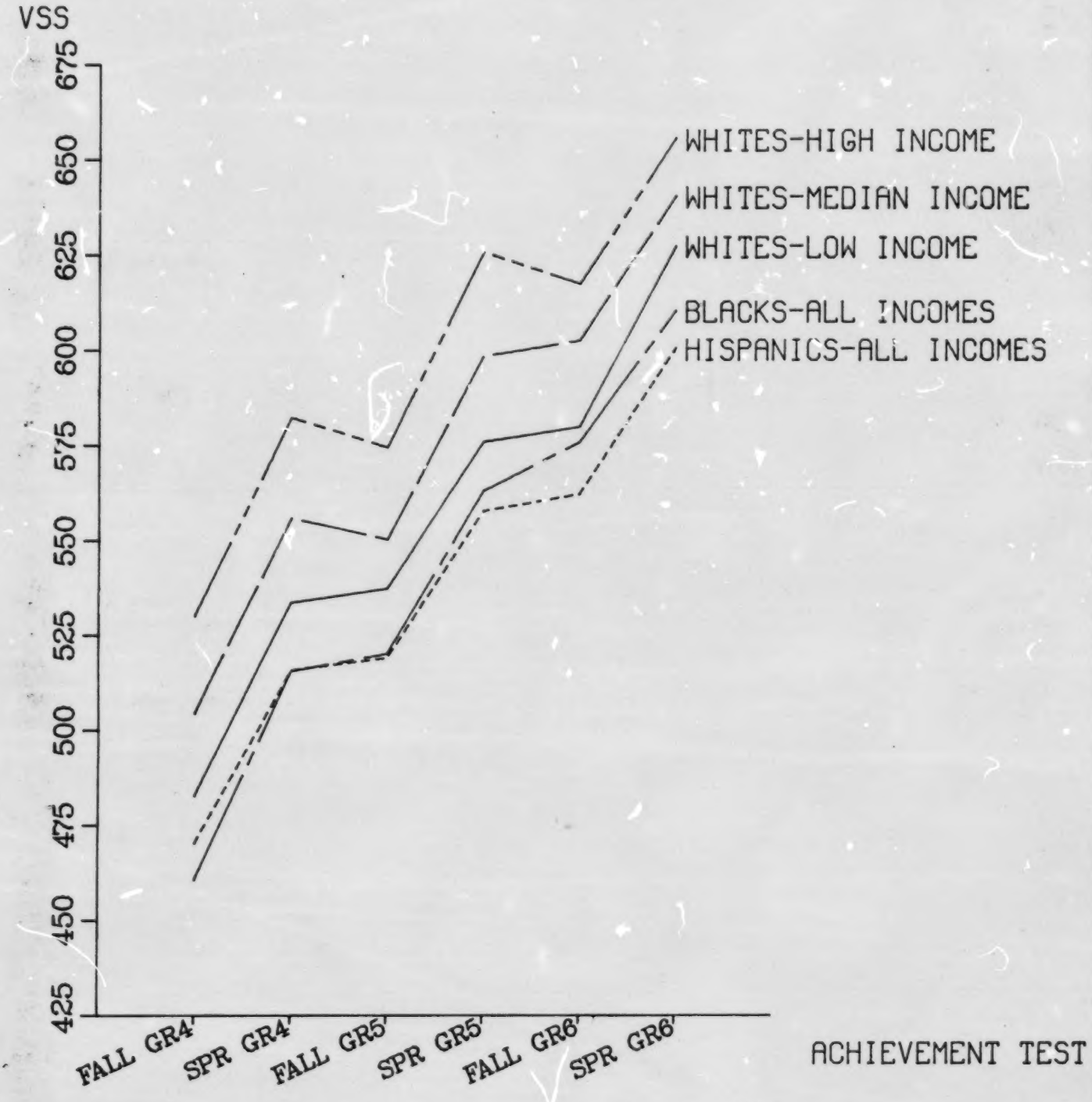
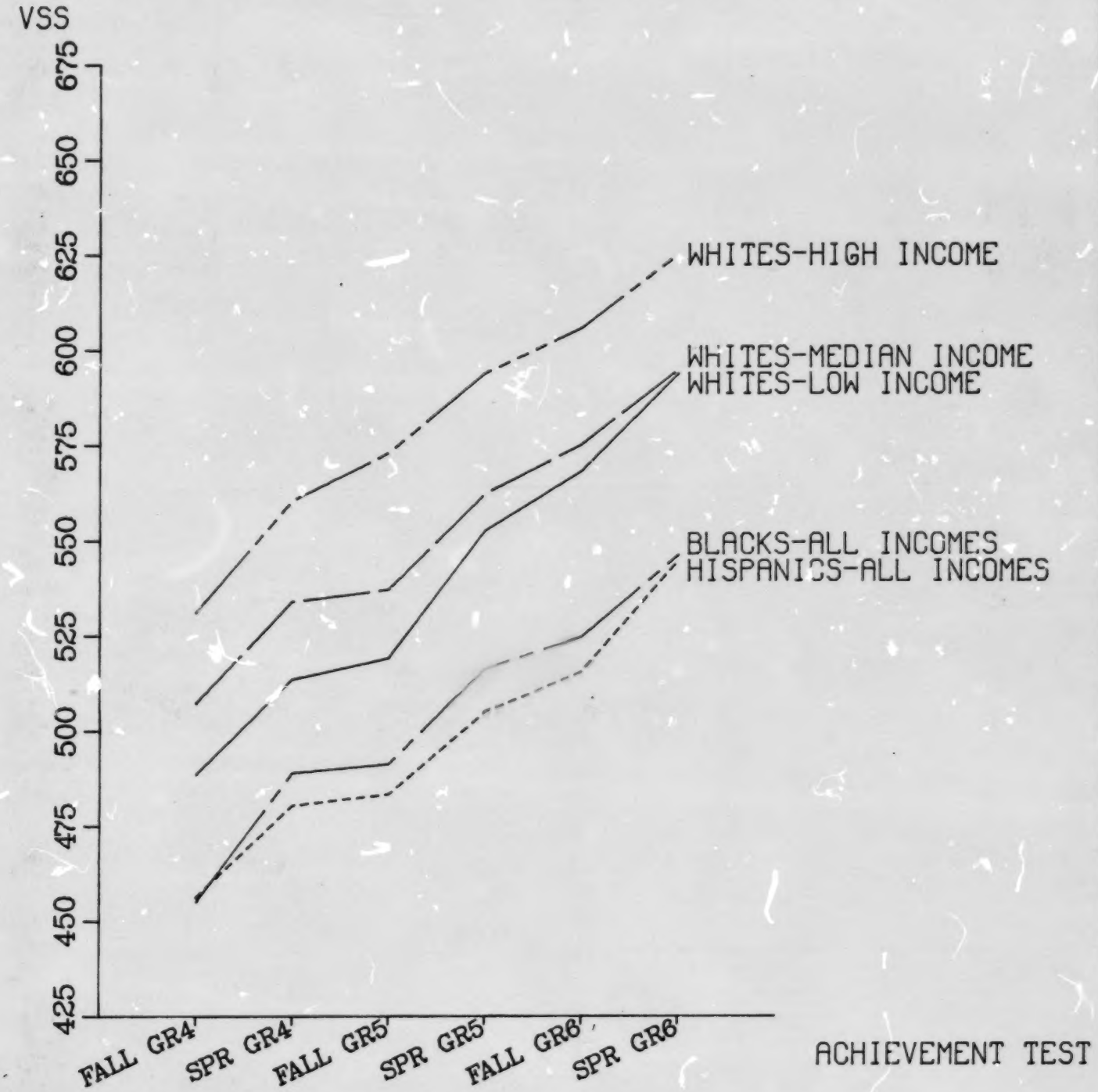


FIGURE 3

MEAN READING VERTICAL SCALE SCORES FOR COHORT IN GRADE 4 IN FIRST YEAR OF STUDY, BY RACE AND INCOME



students from families with low income. For the Sustaining Effects Study data, Figures 2 and 3 confirm Heyns' findings, showing that the achievement level of whites is higher than the achievement level of blacks and Hispanics, and that the higher the family income the higher the student achievement level. The figures also show, however, that all groups have roughly equal achievement change during the school year. While the lines for the different groups are not completely parallel, there are no clear differences among the school-year changes (changes from fall to spring) in either reading or math. There are also no consistent differences in summer learning among groups except that high income whites show a larger reading increase during the summer than do the other groups.

In sum, Figures 2 and 3 show that achievement level differs by income and race, but that achievement change, especially gain during the school year, is the same for all groups. One possible interpretation of this finding is that learning is unrelated to socioeconomic background once students enter school, but that schooling does not overcome prior differences due to home background.

The Effect of School Status

In Table 3.5, page 56 of her study, Heyns presented school-year achievement gains (in GE scores) by race, family income, and school status. A school was considered "high status" if the proportion of students receiving a free lunch was lower than the median proportion in the sample. Heyns found that there was greater equality of gains among students in high-status schools than among students in low status schools, especially for students of different income levels. She concluded that disadvantaged students benefit from attending class with more advantaged peers.

We used mean family income as the measure of status, dividing schools into high and low status at the median. We used family income rather than free lunch participation because free lunch is, at best, a good proxy measure for poverty -- i.e., family income. It is far more desirable to use the intended variable -- income -- than a proxy -- free lunch -- if data on the intended variable are available. Table 4 presents the mean VSS math and reading gains for grade 6 students in the first year of the study, crosstabulated by status, race, and income level. Equality of gains among groups appears to be similar in

TABLE 4

Mean VSS Gains for Grade 6 Students in First Year of Study, by Status, Race, and Income Level

Income Quintile		High Status Schools Whites	High Status Schools Blacks	Low Status Schools Whites	Low Status Schools Blacks
			Math VSS		
Low	(1)	39.1	63.2	31.4	38.5
	(2)	38.3	35.9	42.3	46.5
	(3)	42.5	43.0	44.2	35.0
	(4)	39.7	43.8	43.0	20.4
High	(5)	43.7	40.1	44.6	42.6
			Reading VSS		
Low	(1)	23.1	37.6	20.5	25.4
	(2)	25.0	22.8	27.0	21.9
	(3)	24.9	30.6	27.5	25.5
	(4)	23.6	18.4	25.6	37.4
High	(5)	25.4	25.2	27.8	20.5

Key: VSS = Vertical Scale Scores

high- and low-status schools. Thus, we do not replicate Heyns' finding. We therefore conclude that attendance in class with more advantaged peers is not necessarily beneficial.

Socioeconomic Background and Schooling

Chapter 4 of Heyns' book extends her analysis by increasing the clarity with which she modeled the achievement process. She added measures of parental education, household size, and IQ to prior achievement, family income, and race in order to investigate the relationship of socioeconomic background to achievement. Heyns' major conclusions are as follow:

- Students of higher socioeconomic status have a higher achievement level;
- Schooling reduces socioeconomic effects since learning during the school year is only modestly related to background; but
- Schooling does not fully equalize achievement level. Higher socioeconomic status results in higher initial achievement level and greater summer learning.

Findings from the replication using Sustaining Effects Study (SES) data also show that socioeconomic background variables exert an influence on initial achievement levels. Moreover, schooling does reduce socioeconomic background effects on learning. However, socioeconomic status does not appear to be related to summer achievement change.

Relationship of Socioeconomic Status to Achievement

Heyns included family income, mean parental education, household size, and prior achievement in her regression models and computed regressions for whites, for blacks, and for the total sample. For the total sample, race is included as a dummy variable.

Her analyses show that for both grade-6 and grade-7 samples, income, parental education, and race are significant predictors of achievement level when prior

achievement is not controlled. When prior achievement is controlled, parental education and race remain related to achievement change, while family income is related to achievement change only for the tests administered in the fall. The effects of prior achievement are smaller during the summer months than during the school-year.

In the replication using SES data, models were run for each of grades 1 to 4 in the first year of the study.[4] Table 5 presents the results for all students who were in grade 1 in the first year of the study.[5] From Table 5 we see that parents' education and race almost always have a significant effect on achievement when not controlling for prior test, and are sometimes significant when prior achievement test is controlled. However, unlike the results from the analysis of Heyns' data the income effect has no clear pattern. In fact, in only one of 22 equations is income significant. Household size is significant four times. The results are similar for the other cohorts.

It appears reasonable to conclude from the replication results that no consistent relationship exists between income and achievement, but a relationship does exist between parental education and achievement level, when no correction is made for prior achievement. However, when prior achievement is controlled, achievement change is not strongly affected by parental education. This conclusion is consistent with our previous findings that learning is not closely related to background when prior achievement is controlled.

Estimating the Effects of Schooling

Heyns continued her analysis by adding several terms to the regression model: the difference of school year from summer learning (S = the school-year difference) and interactions of this term with prior achievement, income, parental education, and IQ. She found that school-year learning is greater than summer learning and that socioeconomic background has less effect on school-year gain than on summer learning.

Table 6 presents a replication of Heyns' analysis for all cohorts with three years of data. Analyses were run for all test dates (tests 2 through 6) with achievement at time (t) predicted by achievement at time (t - 1), income, race, and parents' education.[6] Values in the various

TABLE 5

Regression Results for Cohort in Grade 1 for First Year of Study[a]

Test	Intercept	Income/ 1,000	Parents' Education	Household Size	Race[b]	Prior Test	R^2
Math							
Fall Grade 1	276[c]	.146	4.90[c]	.43	14.0[c]		.17
Spring Grade 1	345[c]	.074	5.03[c]	-.43	19.6[c]		.13
	140[c]	-.035	1.39	-.75	8.7	.743[c]	.44
Fall Grade 2	358[c]	.120	4.34[c]	-.10	23.3[c]		.11
	100[c]	.065	.58	.22	8.7	.746[c]	.55
Spring Grade 2	411[c]	.180	4.06[c]	.12	14.5[c]		.07
	136[c]	.088	.73	.20	-3.4	.768[c]	.54
Fall Grade 3	412[c]	.085	4.06[c]	-.62	11.1[c]		.07
	93[c]	-.055	.91	-.72	.2	.775[c]	.64
Spring Grade 3	432[c]	.282	6.21[c]	1.33	26.0[c]		.13
	88[c]	.211	2.82[c]	1.85	16.7[c]	.836[c]	.57
Math							
Fall Grade 1	315[c]	.256	3.75[c]	-1.88	16.3[c]		.19
Spring Grade 1	348[c]	.207	5.97[c]	-.71	8.5		.15
	108[c]	.012	3.13[c]	.72	3.9	.759[c]	.40
Fall Grade 2	373[c]	.344	5.67[c]	-2.63	18.3[c]		.17
	71[c]	.164	.47	-2.01[c]	10.9[c]	.870[c]	.72
Spring Grade 2	417[c]	.562[c]	5.43[c]	-2.89	23.7[c]		.17
	105[c]	.275	.70	-.70	8.5	.834[c]	.65
Fall Grade 3	390[c]	.442	7.37[c]	-.92	15.5[c]		.17
	30[c]	-.044	2.69[c]	1.57	-5.1	.864[c]	.76
Spring Grade 3	445[c]	.434	7.45[c]	-4.08[c]	28.3[c]		.21
	110[c]	.055	1.12	-3.28[c]	15.0[c]	.857[c]	.79

a/ N = 502.

b/ White = 1.
Black = 0.

c/ $p < .05$.

TABLE 6

Regression Results With Added Terms for School Year Difference, by Grade Cohorts[a]

Grade Cohort	N	Intercept	Prior Achievement	School Years(S)	Income/ 1,000	Parents' Education	Race[b]	S X Prior Achievement	S X Income	S X Education	S X Race	R^2
						Math						
1	4024	83[c]	.778[c]	2.70	.035	-121.58	6.43[c]	.117[c]	-.008	122.71	-2.96	.72
2	3693	72[c]	.799[c]	37.26[c]	-.066	-12.81	-.95	.021	.139	14.83	9.12	.67
3	3650	84[c]	.779[c]	25.27[c]	.323[c]	1.84	2.92	.054[c]	-.104	.38	11.04[c]	.68
4	3168	72[c]	.830[c]	39.67[c]	-.259	-2.03	2.20	.003	.284	4.14	.20	.69
						Reading						
1	4024	33[c]	.876[c]	88.10[c]	.016	1.72	2.81	-.120[c]	.000	.95	3.46	.73
2	3693	34[c]	.897[c]	81.55[c]	.032	93.88	4.21	-.121[c]	.102	-91.83	5.59	.74
3	3650	2	.966[c]	98.85[c]	.302[c]	75.25	1.58	-.138[c]	-.315[c]	-73.80	8.58[c]	.78
4	3168	32[c]	.910[c]	36.21[c]	.186	11.88	5.41	-.028	-.269[c]	-10.06	-3.32	.81

[a] All tests for math or reading were combined in estimating the equation. The size (N) is the sum of all tests for which there are no missing values.

[b] White = 1
Black = 0.

[c] $p < .05$.

regressions in Table 6 are not consistently significant, but some tendencies can be noted. Prior achievement and, additionally, the school-year difference effect and/or the school-year difference by prior achievement interaction effect are always significant.

A few of the coefficients for income, race, and the interactions of the school-year difference with income and race are significant. However, it appears that any relationship between achievement change and socioeconomic status is, at best, tenuous. This finding goes beyond Heyns in that even those small relationships between learning and socioeconomic status Heyns found in her Atlanta sample are larger than those found in the Sustaining Effects Study.

Implications for Models of Status Attainment

Heyns found that correlations among measures of socioeconomic status and achievement decrease from grade 6 to the end of high school, implying that background becomes less important as students receive more schooling. These correlations also indicate that schooling equalizes achievement levels. That is, the relationship between home background and achievement level declines as the student experiences more schooling. The initial educational deficit that results from a disadvantaged home background is greatly reduced by school attendance. Heyns reports correlations of achievement with income for her sixth grade cohort of between .37 and .43 which she compares to correlations of between .21 and .26 from previous studies of high school seniors.

In the SES data, correlations with family income range from .18 to .29; correlations with mean parental education range from .26 to .43. There is no tendency for either correlation to decrease from grades 1 to 6. Further, the income correlations (.18 to .29) are in line with the values reported for high school seniors (.21 to .26) 7/. The implication of the Sustaining Effects' correlation coefficients is that schooling does not equalize initial differences in achievement levels caused by differences in socioeconomic background.

The Effects of Attendance

In Chapter 5 of her study, Heyns examined the effect of school attendance on achievement change. The purpose of this analysis was to determine whether a greater

exposure to schooling increases achievement, given that a student is required to attend school during the school year. She cames to two major conclusions:

- Greater absenteeism resulted in lower school-year learning, especially for blacks and for low-income groups in general.

- The best attendance records were found among blacks and among low-income students in general.

In our replication, we found only a weak link between achievement and attendance. Even for children of low socioeconomic status, attendance and achievement are not consistently related. However, we found support for a relationship between absenteeism and socioeconomic status.

Attendance and Achievement

Heyns found that the greater the absenteeism, the lower the spring achievement (when fall achievement is controlled). The effect is greatest for black students, even when socioeconomic status (mean parental education, household size, and family income) are controlled. She also found the negative relationship to be largest in the lowest-income groups.

Table 7 presents a replication of these analyses using the Sustaining Effects data. In Table 7 regressions by grade and race with only prior achievement controlled are presented on the left-hand side, while the regressions that also control for the socioeconomic variables are presented on the right-hand side. The results in Table 7 show large differences across grades. In some grades the effect of attendance is greater for whites, while in others it is larger for blacks. In most cases the coefficients are larger for math than for reading. And in almost all cases the absolute value of the coefficient is smaller when socioeconomic status variables are controlled. When we replicated this analysis for income levels (the table is not reproduced), we found the same inconsistency of results. No effect of income level seems to be present.

Determinants of Absenteeism

Table 5.4 in Heyns' study presents mean days absent by race and income. She found that in Atlanta, blacks show consistently higher attendance records than whites do, and

TABLE 7

Regression Coefficients for Achievement on Weeks Attended School, Controlling for Fall Achievement, by Grade and Race, First Year of Study[a/]

Grade	Simple Regression				Control for Three Socioeconomic Status Variables[b/]			
	Whites		Blacks		Whites		Blacks	
READING								
Grade 1	0.95	(2.62)	2.23	(2.91)	0.59	(1.60)	1.94	(2.57)
Grade 2	0.75	(2.21)	0.72	(0.98)	0.50	(1.45)	0.37	(0.50)
Grade 3	0.93	(3.13)[c/]	-0.67	(0.98)	0.60	(1.95)	-0.60	(0.85)
Grade 4	0.23	(0.73)	1.27	(2.50)	0.05	(0.14)	1.23	(2.31)
Grade 5	-0.09	(0.26)	-0.18	(0.20)	-0.19	(0.55)	0.07	(0.08)
Grade 6	0.66	(2.47)	2.32	(3.26)[c/]	0.51	(1.88)	2.08	(2.86)
MATH								
Grade 1	0.65	(1.92)	2.62	(3.46)[c/]	0.44	(1.26)	2.45	(3.22)[c/]
Grade 2	1.05	(2.72)[c/]	3.16	(3.37)[c/]	0.73	(1.84)	2.77	(2.89)[c/]
Grade 3	2.59	(6.45)[c/]	1.26	(1.32)	1.96	(4.79)[c/]	0.64	(0.65)
Grade 4	1.43	(3.31)[c/]	1.12	(1.80)	1.30	(3.00)[c/]	0.91	(1.40)
Grade 5	1.70	(3.35)[c/]	-0.21	(0.18)	1.65	(3.20)[c/]	-0.36	(0.31)
Grade 6	1.42	(3.37)[c/]	1.20	(1.39)	1.14	(2.66)[c/]	0.88	(0.99)

a/ Ordinary least squares (OLS) t-value in parentheses.
b/ The three variables are mean parental education, household size, and family income.
c/ $P < .05$. This was calculated by dividing the OLS t-value by estimated design effects -- 1.5 for reading and 1.25 for math. The result was compared with tabled t-values.

23.

that higher income-level students in general have better attendance records than do students of lower income.

Table 8 replicates Heyns' Table 5.4. In the Sustaining Effects data there is a clear tendency for student with higher family incomes to have less absenteeism. Within race and grade subcategories, the higher the income quintile, the higher the mean attendance, with eight exceptions. (Exceptions are noted in the table.) There is no consistent pattern of higher attendance for one race over the other.

The final column of Table 8 presents the Pearson correlation coefficients between weeks of school attendance and income, by grade and race. All but two of the coefficients, one for each race, are significant; this finding also supports Heyns' finding of a relationship between income and absenteeism.

Conclusions

The major finding of Heyns' Summer Learning and the Effects of Schooling, that school-year learning is much greater than learning during the summer, was supported by this replication. This is the case for all students taken together and for each socioeconomic group taken alone.

The replication of the relationship of socioeconomic background to achievement yielded only partial support for the findings on Heyns' Atlanta sample. Consistent with the Atlanta study was the relationship of socioeconomic background to achievement level of the students. Students whose parents have higher incomes or higher education receive higher scores on achievement tests.

Contrary to findings on the Atlanta sample, however, we found little or no relationship between socioeconomic background and learning -- either school-year learning or summer learning. Heyns had found that there was a moderate relationship between background and learning, although the relationship was lower than that between background and achievement level. Our findings indicate that background affects initial achievement level and that initial differences between groups are maintained through the elementary school grades.

The relationship between school attendance records and achievement change found in the Atlanta study was not supported by the Sustaining Effects data. While students'

TABLE 8

Mean Weeks of Attendance by Grade, Race, and Income Quintile, First Year of Study

Race/ Grade	Mean Weeks of Attendance, by Income Quintile						Correlation of Attendance and Income
	All Incomes	Lo (1)	(2)	Med (3)	(4)	Hi (5)	
WHITE							
Grade 1	33.5	32.7	33.1	33.5	34.0	34.2	0.189
Grade 2	33.9	33.0	33.4	33.9	34.1	34.6	0.202
Grade 3	33.9	32.3	33.6	33.9	34.3	34.4	0.193
Grade 4	34.0	33.3	33.8	34.1	34.0[a]	34.2	0.056[b]
Grade 5	34.1	33.1	33.7	34.1	34.3	34.3[a]	0.137
Grade 6	33.9	32.6	33.5	34.2	34.3	34.3[a]	0.165
BLACK							
Grade 1	33.2	33.2	33.3	33.5	33.4[a]	33.9	0.100[b]
Grade 2	33.5	33.2	33.5	33.7	34.6	35.0	0.191
Grade 3	34.1	33.6	34.5	34.6	35.1	34.8[a]	0.259
Grade 4	33.6	33.2	33.1[a]	34.4	34.6	35.2	0.200
Grade 5	34.3	33.9	35.0	34.0[a]	35.1	35.0[a]	0.139
Grade 6	33.7	33.5	33.7	33.9	34.2	34.7	0.164

a/ Denotes an exception to the monotonic relationship between income quintile and attendance.

b/ This correlation coefficient is not significant at $p < .05$.

socioeconomic status appears to be related to their school attendance records, students' attendance records seem to have little effect on their school-year learning.

Although some elements of Heyns' results were not supported in our replication, we did find support for her most important finding. More learning occurs in school than out of school (Summer). Although we did not comfirm Heyn's finding that schooling has larger effects for the disadvantaged students than for others, we did replicate the finding that schooling is equalizing in the sense that the preexisting differences in achievement do not get worse during the school year. This finding contradicts the "fan-spread hypothesis" (Campbell, 1970) that posits that differences between disadvantaged and other students increase over schooling. The hypothesis implies that disadvantaged students learn less quickly than other students and so fall further behind the norm in the absence of special help. Our findings imply that disadvantaged students learn as well as more advantaged students during the school year. Heyns' findings differ from our in that she finds that disadvantaged students actually learn more when in school.

The importance of schooling is also shown by differences in rates of learning reading and math over the school year and summer. The school effect is much more pronounced for math. This is consistent with the notion that math is more school-dependent than reading is. When not in school students have more opportuntity to practice and develop their reading skills than their math skills.

The most important conclusion to emerge from both Heyns' study and this replication is that schooling has a powerful effect on achievement. Contrary to the assertions of those who choose to interpret the cross-sectional data in the Coleman et al. (1966) study as indicating that school has little effect on achievement, which is entirely preordained by family income, we find quite the opposite when considering longitudinal achievement data. Both Heyns' and the Sustaining Effects Study longitudinal data clearly show that going to school produces gains in achievement.8/

The two studies differ on the extent to which schooling equalizes initial differences in achievement that seem to result from home background. Heyns found the pre-schooling gap was narrowed by school. We found equal rates of learning for both advantaged and less advantaged students. Both Heyns' and our findings contradict the "fan-spread

hypothesis" that disadvantaged students fall further behind the norm during their school careers. One could account for the difference between Heyns' and our finding by speculating that Atlanta has a better-than-average compensatory education program, one that is meeting the goals of Title I and is succeeding in reducing the educational disadvantage caused by poor socioeconomic background.

Notes

1. One problem in comparing school year with summer achievement change lies in the different amounts of time involved. The achievement tests are given in October and May. This creates a school year period of about seven months and a summer period of about five months. Heyns does not address the problems the different period lengths may cause.

2. This cohort is presented because data for fall-spring-fall were needed in the replication and this cohort was the oldest cohort for whom two years of data were available.

3. This cohort is presented because we wish to show data over three years and this is the oldest cohort for whom these data are available.

4. Several measurement problems exist for the variables used in the Sustaining Effects Study data. Parental education is measured only in discrete categories which we translated to years of schooling: less than high school = 7, 9 to 11 years = 10, high school = 12, some college = 14, college education = 16, postgraduate = 18. These are averaged if there were two parents. Household size is found by adding family size and other household members. Students with more than the maximum family size (11) or household members (2) were assumed to have the maximum size allowed. Of the 15,579 students, 1.3 percent had 11 or more in their family and 0.9 percent had 2 or more other household members.

5. This cohort is presented because the fall meaurse in the first year of the study is of achievement at the earliest possible stage in the student's schooling. Thus, effects of socioeconomic variables are influenced by the minimum prior schooling. The other five achievement tests trace the effects of school over time.

6. Heyns' equation included IQ but the Sustaining Effects Study did not measure IQ.

7. These correlations use only fall test scores in the first year of the study in order to minimize the time lag between measurement of socioeconomic variables and achievement.

8. We are now analyzing the Sustaining Effects Study data with methods that use as much information as possible. Using combined regressions for all five learning periods (three school-year, two summer), we expect to derive estimates of the differences in school-year vs. summer learning for both reading and math.

References

Campbell, D. T., and Erlebacher, A. "How Regression Artifacts in Quasi-Expermental Evaluations Can Mistakenly Make Compensatory Education Look Harmful," in J. Hellmuth (Ed.), Compensatory Education: A National Delate (Vol. 3). New York: Bruner-Mazel, 1970.

Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPartland, J., Mood, A. M., Weinfeld, F., and York, R. L. Equality of Opportunity. Washington, DC: U.S. Government Printing Office, 1966.

Hemenway, J. A., Wang, M., Kenoyer, C. E., Hoepfner, R., Bear, M. B., and Smith, G. The Measures and Variables in The Sustaining Effects Study. Santa Monica, CA: System Development Corp., 1978.

Heyns, B. Summer Learning and the Effects of Schooling. New York: Academic Press, 1978.

Hoepfner, R., Wellisch, J., and Zagorski, H. The Sample for The Sustaining Effects Study and Projections of Its Characteristics to the National Population. Santa Monica, CA: System Development Corp., 1977.

Jencks, C. S. "Forward," in B. Heyns, Summer Learning and the Effects of Schooling. New York: Academic Press, 1978.